

# PATENT ABSTRACTS OF JAPAN

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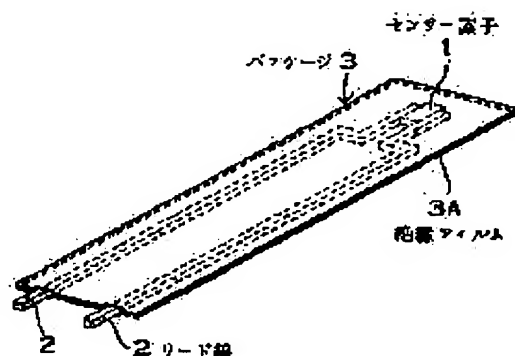
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## (54) TEMPERATURE SENSOR AND PACK BATTERY

### (57)Abstract:

**PURPOSE:** To provide a compact pack battery of which a thin temperature sensor is mass-produced inexpensively, short-circuit of the lead wire of the temperature sensor is effectively prevented, and a battery temperature is precisely detected.

**CONSTITUTION:** A temperature sensor is provided with a sensor element 1 which detects a temperature, a lead wire 2 connected to the sensor element 1, and a package 3 which covers a part of the lead wire 2 and the sensor 1. The package 3 is a two-layer insulation film 3A adhered to each other, and the sensor element 1 and part of the lead wire 2 are pinched between the two-layer insulation film 3A. A temperature sensor which makes the package 3 a two-layer laminated insulation film 3A is built in a pack battery in a state adhered to the surface of the battery.



## LEGAL STATUS

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CLAIMS

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[Claim(s)]

[Claim 1] In the thermo sensor (5) which has the package (3) which covers the sensor component (1) which detects temperature, and the part and sensor component (1) of the lead wire (2) connected to this sensor component (1), and lead wire (2) The thermo sensor characterized by fastening and covering some of sensor components (1) and lead wire (2) with the two-layer insulating film (3A) each other stuck to the package (3) between two-layer insulating films (3A).

[Claim 2] The sensor component for which is equipped with the thermo sensor (5) which detects the temperature of a rechargeable battery and this rechargeable battery, and a thermo sensor (5) detects temperature (1), In the pack cell which has the lead wire (2) connected to this sensor component (1), and the package (3) which covers the part and sensor component (1) of lead wire (2) The pack cell characterized by fastening some of sensor components (1) and lead wire (2) between two-layer insulating films (3A), and being covered with the insulating film (3A) with the two-layer insulating film (3A) each other stuck to the package (3) of a thermo sensor (5).

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DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the pack cell having a thermo sensor and this thermo sensor.

[0002]

[Description of the Prior Art] the conventional thermo sensor -- drawing 1 -- \*\* -- like, lead wire was connected to the sensor component 1, and the sensor component 1 and the point of lead wire 2 are covered with the packages 3, such as an epoxy resin. The component from which resistance changes with temperature is used for the sensor component 1. The thermo sensor of this structure connects lead wire 2 to the sensor component 1 by approaches, such as soldering, applies a paste-like epoxy resin to a part for a point and its front face of the sensor component 1 and lead wire 2, and is manufactured. When the head of lead wire 2 approaches mutually, in order to prevent a short circuit, the protective tubing 4 was inserted in lead wire 2, and the epoxy resin is applied.

[0003] Furthermore, the pack cell contains the thermo sensor 5, in order to detect cell temperature and to control a charge condition. It is because the cell engine performance will fall if boosting charge is carried out after cell temperature has risen. A thermo sensor 5 is stuck on the surface of a cell with silicon resin etc., in order to detect cell temperature to accuracy. Drawing 2 shows the pack cell having four square shape cells 6 and a thermo sensor 5. The pack cell of this drawing is fastening the head of a thermo sensor 5 between the square shape cells 6 so that a thermo sensor 5 can detect cell temperature to accuracy more. If the head of a thermo sensor 5 is contacted on the front face of a pack cell, it will become difficult for a thermo sensor 5 to detect cell temperature to accuracy more. It is because one side of a thermo sensor 5 is shown in the front face of a pack cell and is cooled. Both sides contact on the surface of a cell, and the thermo sensor 5 fastened between cells can detect cell temperature to accuracy more.

[0004]

[Problem(s) to be Solved by the Invention] As shown in drawing 1, the thermo sensor 5 which inserts a protective tubing 4 in lead wire 2, and is covered with the sensor component 1, the point of lead wire 2, and the package 3 of an epoxy resin has the fault to which the part of the sensor component 1 which detects temperature becomes thick. It is because the lead wire 2 which inserted the protective tubing 4 and became thick is covered with an epoxy resin in addition to the package 3 of an epoxy resin becoming thick. The thermo sensor 5 without a protective tubing 4 can solve the problem to which a protective tubing 4 thickens the sensor section. However, the thermo sensor 5 without a protective tubing 4 has the fault in which lead wire 2 tends to short-circuit. Moreover, even if it omits a protective tubing, the sensor section is not made so thinly. It is because the epoxy resin which is the package of a sensor component is fairly thick.

[0005] The sensor section can be made thin if the epoxy resin which is a package is made thin. However, if the epoxy resin of a package is made thin, dependability will fall remarkably. It is because it becomes impossible for a package to fully protect a sensor component. Furthermore, the thermo sensor which uses a package as an epoxy resin has the fault in which a crack tends to go into an epoxy resin, when lead wire is pulled. In order to prevent this fault, it is necessary to make an epoxy resin still thicker. Thus, the conventional thermo sensor has a fault with it difficult [ to make the sensor section thin ].

[0006] If a thick thermo sensor is fastened between cells as shown in drawing 2, as shown in the sectional view of drawing 3, the clearance between cells (t) will become large and the appearance of a package 3 will become large. Furthermore, since lead wire 2 also becomes thick, the thermo sensor 5 which covers lead wire 2 with a protective tubing 4 also has the fault to which a pack cell becomes thick substantially. It is because lead wire 2 projects on the front face of a pack cell.

[0007] Furthermore, the thermo sensor which uses a protective tubing in order to prevent the short circuit of lead wire needs to insert a protective tubing, when manufacturing. The thin lead wire 2 cannot be inserted easily [ the thin protective tubing 4 ]. For this reason, there is a fault to which inserting a protective tubing in lead wire takes time and effort, and a manufacturing cost becomes high.

[0008] This invention was developed for the purpose of solving the conventional faults, such as this, and the important object of this invention is to offer the thermo sensor which makes it thin and can prevent the short circuit of lead wire effectively while being able to carry out high production cheaply.

[0009] Furthermore, other important objects of this invention are to offer the pack cell which makes an appearance small and can be designed in a compact while being able to detect cell temperature to accuracy.

[0010]

[Means for Solving the Problem] The thermo sensor and pack cell of this invention are equipped with the following configuration in order to attain the above-mentioned object. A thermo sensor 5 is equipped with the package 3 which covers the sensor component 1 which detects temperature, the lead wire 2 connected to this sensor component 1, and the part and the sensor component 1 of lead wire 2.

[0011] A package 3 is two-layer insulating film 3A to which it was stuck mutually. Two-layer insulating film 3A has fastened and covered some of sensor components 1 and lead wire 2 in between.

[0012] Furthermore, the pack cell of this invention is equipped with a rechargeable battery and the thermo sensor 5 which detects the temperature of this rechargeable battery. A thermo sensor 5 has the package 3 which covers the sensor component 1 which detects temperature, the lead wire 2 connected to this sensor component 1, and the part and the sensor component 1 of lead wire 2.

[0013] Furthermore, the pack cell of this invention uses two-layer insulating film 3A to which it was stuck mutually for the package 3 of a thermo sensor 5. Two-layer insulating film 3A has fastened and covered some of sensor components 1 and lead wire 2 in between.

[0014]

[Function] The thermo sensor of this invention uses stuck insulation film of two sheets 3A for a package 3. The thermo sensor 5 of this structure can be manufactured on both sides of the sensor component 1 which connected lead wire 2 between stuck insulation film of two sheets 3A which carries out a laminating. Thus, the thermo sensor 5 manufactured can fasten and cover lead wire 2 with insulating film 3A. For this reason, it is not necessary to insert a protective tubing like the conventional thermo sensor, and to carry out insulating processing. For this reason, the thermo sensor of this invention can be insulated so that it may not short-circuit without inserting a protective tubing. It multiplies not to use a protective tubing and that the insulating film of two sheets can be pasted up and manufactured, and it can manufacture cheaply.

[0015] Furthermore, the thermo sensor of this invention manufactured by the insulating film of two sheets on both sides of a sensor component is made thinly. The thermo sensor of the shape of a thin sheet contacts the front face of the member which detects temperature in a large area, and heat conduction is efficiently carried out to it. For this reason, temperature can be measured to accuracy. The package 3 which is insulating film 3A makes the whole thickness thin, and can protect the sensor component 1 to stability. It is because the sensor component 1 is covered with insulating film 3A fabricated in uniform thickness. It is difficult for the conventional thermo sensor which covers a sensor component with an epoxy resin to make a package thin. It is because it is difficult to cover the front face of a sensor component with the epoxy resin of uniform film pressure. Especially the epoxy resin applied to the front face of a sensor component as a package becomes very thin in the periphery of a sensor component. The whole will become thick in order to apply a periphery to sufficient thickness. On the other hand, since the thermo sensor of this invention is covered with the insulating film of uniform film pressure on both sides of a sensor component, it does not become thin in the periphery of a sensor component, makes the whole thin, and can fully protect a sensor component.

[0016] Furthermore, the pack cell of this invention contains the thermo sensor 5 of the shape of a thin sheet whose sensor component 1 is pinched by insulation film of two sheets 3A. As shown in drawing 4 thru/or drawing 6 , the thin thermo sensor 5 is fastened between cells, and can be used conveniently. The thin thermo sensor 5 fastened between cells prevents that approach and cell spacing is made by the useless opening in the interior of a pack cell. For this reason, the appearance of a pack cell is made small and it is made to a compact. Furthermore, as the thermo sensor 5 of the shape of a thin sheet contacts in a large area on the surface of a cell and is especially shown in drawing, the thermo sensor 5 fastened between cells sticks both sides on the surface of a cell. For this reason, heat conducts from a cell efficiently to a thermo sensor 5, and cell temperature can be detected to accuracy without a time lag. Since the pack cell of this invention can also make a temperature sensor lead part thin, as shown in drawing 5 , it has the features which can make

thickness (W) thin further again. It is because lead wire does not project highly from the front face of a pack cell.

[0017]

[Example] Hereafter, the example of this invention is explained based on a drawing. However, the example shown below does not illustrate the thermo sensor and pack cell for materializing the technical thought of this invention, and this invention does not specify a thermo sensor and a pack cell as the following.

[0018] Furthermore, this description has appended the number corresponding to the member shown in an example to the member shown in "the column of a claim", "the column of an operation", and "the column of The means for solving a technical problem" so that it may be easy to understand a claim. However, there is never nothing what specifies the member shown in a claim as the member of an example.

[0019] The thermo sensor 5 shown in drawing 7 consists of packages 3 which have covered the sensor component 1 which detects temperature, two lead wire 2 connected to the electrode of this sensor component 1, and the part and the sensor component 1 of lead wire 2.

[0020] The sensor component 1 can use the thermistor component to which resistance becomes small, if the component from which an electrical property changes with temperature, for example, temperature, becomes high. A thermistor is the outstanding sensor component 1 from which resistance changes with temperature substantially while having sufficient reinforcement. The sensor component 1 is fabricated by tabular [ thin ] in order to make the whole thermo sensor thin.

[0021] The sensor component 1 carried out soldering of the lead wire 2 to the both-sides side, and has connected it with it. In order to make between lines large, lead wire 2 bends a point outside and is arranging it in parallel.

[0022] The package 3 which covers the sensor component 1 and lead wire 2 is two-layer insulating film 3A to which it was stuck mutually. Between two-layer insulating film 3A, some of sensor components 1 and lead wire 2 are fastened and covered. Synthetic-resin films, such as the flexible synthetic-resin film with which insulating film 3A has sufficient reinforcement, for example, polyester resin, polyethylene, polypropylene, nylon, a fluororesin, styrol resin, and a vinyl chloride, are used. Although the thickness of insulating film 3A is adjusted to an optimum value by the class of synthetic-resin film used, about 100-micrometer thing can be preferably used for it. However, the thing of 50-200-micrometer thickness can also be used for insulating film 3A.

[0023] As shown in drawing 8, the thermo sensor 5 shown in drawing 7 carries out soldering of the lead wire 2 to the sensor component 1, sticks insulation film of two sheets 3A, and is manufactured as follows so that this may be inserted.

**\*\*** In order to change the laminating of the insulating film 3A into an adhesion condition, apply adhesives to the adhesion side of insulating film 3A. About 10-100 micrometers of thickness of adhesives are about 30-70 micrometers preferably, for example. Adhesives are applied to adhesion side both sides of insulating film 3A of two sheets which carry out a laminating. However, it can apply to one side and insulating film 3A can also be pasted up. Although an epoxy resin system is the the best for adhesives, the thing of a polyurethane system and an unsaturated-polyester-resin system etc. can use all the adhesives on which an insulating film can be pasted up.

[0024] **\*\*** When adhesives are in the condition of not hardening, fasten the sensor component 1 and lead wire 2 between insulating film 3A, press the whole surface of insulating film 3A by the uniform pressure, and stiffen adhesives. It is stuck to it on the front face of the sensor component 1 and lead wire 2 while being mutually stuck to insulating film 3A which applied adhesives to both sides of an insulating film 3A adhesion side, and was pasted up firmly through adhesives. Furthermore, when the lead wire 2 of an angle cross section is used while fabricating the sensor component 1 to tabular as shown in drawing 7 and drawing 8  $R > 8$ , there are the features that insulating film 3A can be stuck to the front face of the sensor component 1 and the front face of lead wire 2 in a large area. It is stuck to insulating film 3A which applies adhesives to one side of an adhesion side, and is pasted up on it by one side of insulating film 3A and lead wire 2.

[0025] As mentioned above, the thermo sensor 5 on which insulating film 3A is pasted up through adhesives has the features that insulating film 3A can be stuck certainly. However, it is not necessary to surely carry out the thermo sensor of this invention, and adhesives do not need to be used for it, and it does not need to paste up an insulating film. For example, the synthetic-resin film of a low-melt point point can also be stuck to an adhesion side using insulating film 3A which carried out the laminating. This insulating film 3A uses an adhesion side as a low-melt point point synthetic-resin film, and uses the lateral surface as a high-melting synthetic-resin film. Where a sensor component and lead wire are fastened, this insulating film is heated from both sides, and can fuse and stick the low-melt point point synthetic-resin film of an adhesion side.

Heating melting of the low-melt point point synthetic-resin film is carried out, it pastes up the adhesion side of an insulating film, and sticks it also to a sensor component and lead wire further.

[0026] Furthermore, the adhesives of hot melt can also be used for adhesion of an insulating film. In order to stick insulating film 3A using the adhesives of hot melt, the adhesives of hot melt are applied to the adhesion side of insulating film 3A, and the whole surface of insulating film 3A is heated and pressed in the condition that insulating film 3A pinches the sensor component 1 and lead wire 2.

[0027] The insulating film which uses paste-like adhesives, uses the adhesives of hot melt, or is pasted up again using a low-melt point point synthetic-resin film needs to press and stick the whole surface to homogeneity. In order to realize this, the whole surface of an insulating film is pressed through a rubber-like elasticity plate.

[0028] Drawing 8 shows the condition of manufacturing one thermo sensor 5. As shown in drawing 9 R> 9, many thermo sensors 5 which connected lead wire are arranged horizontally, and it fastens and pastes up by long and slender insulating film 3A, and after adhesion, the thermo sensor 5 by which high production is carried out is cut on the boundary of a thermo sensor 5, and can improve [ efficiency ] abundant manufacture. Furthermore, the manufactured thermo sensor 5 can also cut between lead wire 2 in the shape of a slit, as shown in drawing 10 .

[0029] Furthermore, in order to reinforce selectively insulating film 3A which covers the sensor component 1, as the chain line of drawing 8 shows, the reinforcement film 7 is fastened to the part which covers the sensor component 1. The reinforcement film 7 is fastened between the sensor component 1 and insulating film 3A. What made the tough synthetic-resin film, for example, an epoxy resin, the shape of a film can be used for the reinforcement film 7. Furthermore, a sensor component can be effectively protected from moisture by using a synthetic-resin film without permeability and water flow nature for the reinforcement film 7.

[0030] Drawing 4 and drawing 5 show the pack cell having the thermo sensor 5 manufactured by the aforementioned approach. Four square shape slim cells 6 were arranged in parallel, it fixed on the tape, and the pack cell shown in drawings, such as this, has covered the front face with the envelope of heat-shrinkable tubing 8. The head of a thermo sensor 5 is bent in the shape of L character, and is fastened in the medium of a cell. As shown in drawing 6 , the thermo sensor 5 has bent the head in the shape of L character, so that the part which builds the sensor component 1 in the interior can be fastened between cells 6. Field contact of the part which builds the sensor component 1 at the head of a thermo sensor 5 is carried out in a large area on the surface of a cell in both sides. For this reason, the heat of a cell is efficiently conducted to a thermo sensor 5. For this reason, although it is not necessary to necessarily apply silicon resin etc. between a thermo sensor 5 and a cell, there are the features which can conduct the heat of a cell to a thermo sensor 5 still more efficiently by applying silicon resin in the meantime.

[0031]

[Effect of the Invention] The thermo sensor and pack cell of this invention have the features which were excellent in the following.

\*\* The high production of the thermo sensor can be carried out cheaply. It is in the condition which does not need to apply an epoxy resin to thickness exact on the front face of a sensor component, and does not need to insert a protective tubing in lead wire like the conventional thermo sensor, and fastens some lead wire and both sides of a sensor component to the insulating film of two sheets, and is because the insulating film of each other is stuck and can be manufactured.

[0032] \*\* In spite of not using a protective tubing, there are the features which can be prevented effectively about a temperature sensor lead short-circuiting. That is because the thermo sensor of this invention fastened some lead wire with the insulating film and has insulated. Since especially the insulating film that is the package of the thermo sensor of this invention has fastened and covered a sensor component and some lead wire, when lead wire is pulled in addition to the ability to prevent the short circuit of lead wire effectively, a crack etc. does not generate it like the package of the conventional epoxy resin. For this reason, sufficient reinforcement for the package of a thermo sensor can be given.

[0033] \*\* A thermo sensor can be made thin. That is because the front face of a sensor component and lead wire is covered with the insulating film of uniform thickness. A thin thermo sensor carries out field contact in an area large on the front face of the member which detects temperature. Furthermore, spacing of a sensor component and the member which detects temperature can be narrowed. For this reason, a thermo sensor has the features that moreover temperature is promptly detectable in accuracy.

[0034] \*\* A pack cell detects cell temperature to accuracy, and, moreover, can make an appearance small. That is because the thermo sensor of the shape of a thin sheet is built in. As shown in drawing 6 , it is

fastened between cells, or although a thin thermo sensor is not illustrated, it is stuck on the surface of a cell, and detects cell temperature to accuracy. It is because thermal resistance between a cell and a sensor component is made small and heat conduction can be made efficient. For this reason, although the whole configuration is compact, the ideal pack cell which can detect cell temperature to accuracy is realizable.

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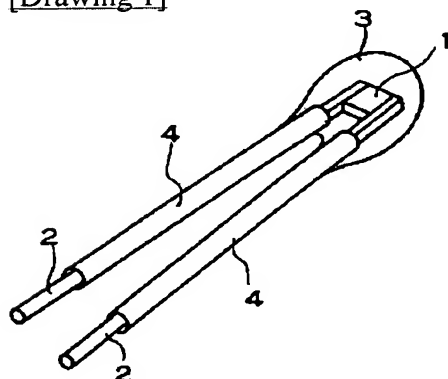
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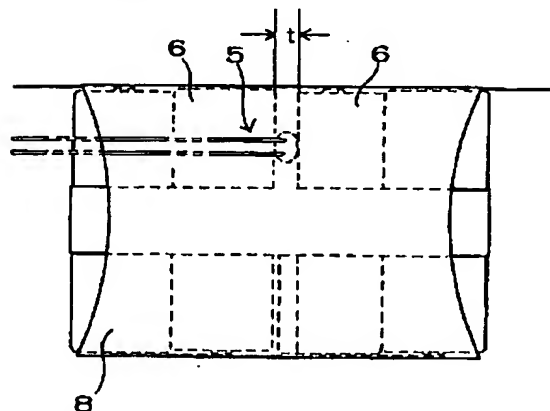
DRAWINGS

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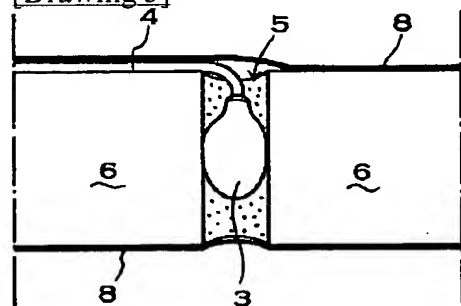
[Drawing 1]



[Drawing 2]

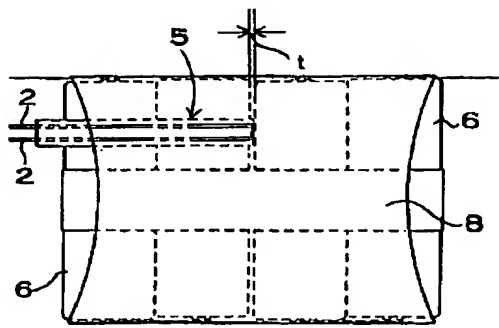


[Drawing 3]

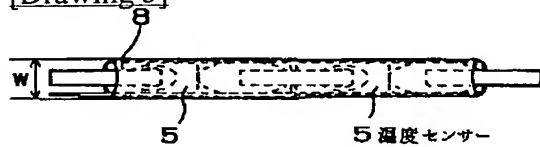


[Drawing 4]

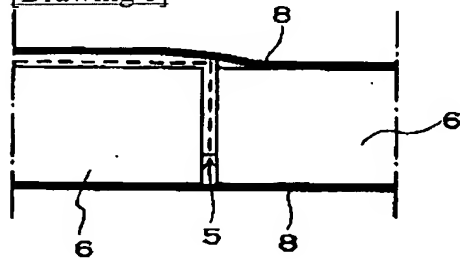




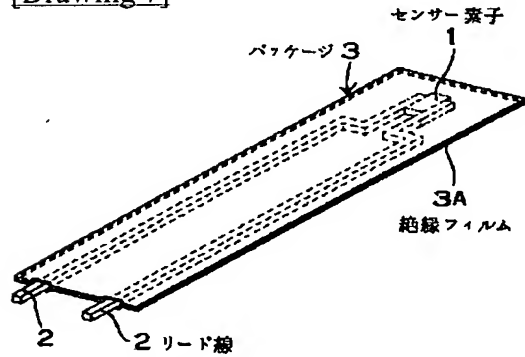
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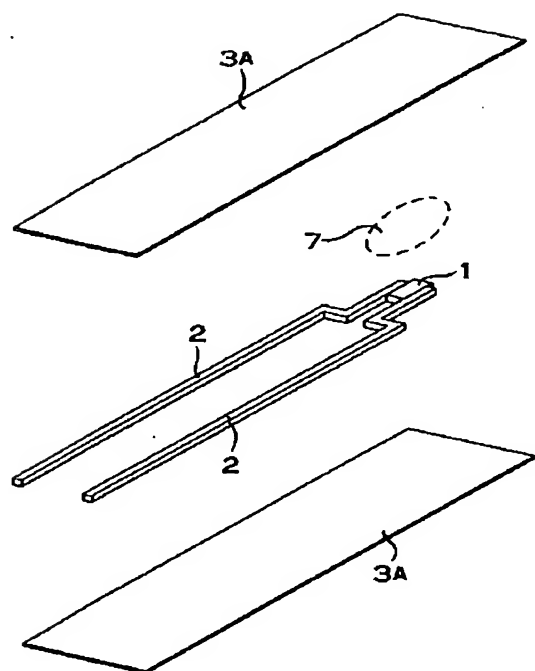
[Drawing 6]



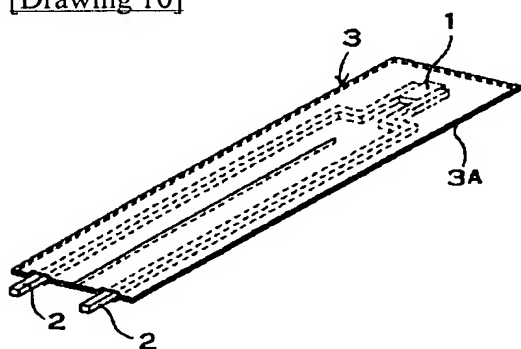
[Drawing 7]



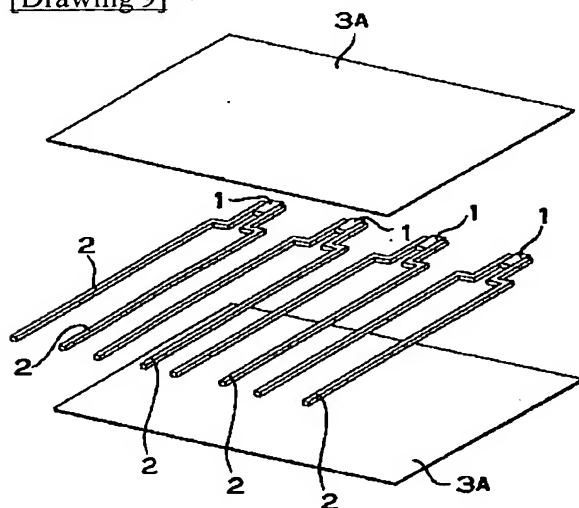
[Drawing 8]



[Drawing 10]



[Drawing 9]



[Translation done.]